CLAIMS

1. An optical fiber, comprising:

a plurality of air holes around a core,

wherein said air holes in proximity of a connecting end of said optical fiber are filled with a light transparent material made of a resin or a glass or the like that has a refractive index lower than that of a quartz-based material.

2. The optical fiber according to claim **1**, wherein:

said optical fiber is a photonic crystal fiber that said air holes are periodically arranged in a hexagonal lattice form from a central portion of the optical fiber, where a crystal defect exists.

3. The optical fiber according to claim **1**, wherein:

said optical fiber is a Holey fiber that comprises, in said core or a cladding thereof, said plurality of air holes extending in an axial direction of the Holey fiber.

4. The optical fiber according to claim **1**, wherein:

the resin filled in said air holes is a UV-curable resin.

5. An optical fiber connection method, comprising:

by using a V-groove splicer or the like, connecting end-to-end said optical fiber as defined in claim 1 to an optical fiber that has a mode field diameter larger than that of said optical fiber as defined in claim 1 on a V-groove of said V-groove splicer.

6. An optical fiber connector, comprising:

a ferrule on which said optical fiber as defined in claim **1** is mounted, said optical fiber being ground at an end face thereof.

7. A sealing structure of an end portion of an optical fiber, comprising:

a high refractive index core; and

a low refractive index cladding formed around said core, said cladding comprising a plurality of air holes extending in an axial direction of said optical fiber,

wherein said air holes are sealed by a sealing portion made of glass in said end portion, and

said cladding comprises a portion in which said sealing portion is formed and which is provided with a diameter that is the same as that of a portion in which said sealing portion is not formed.

8. The sealing structure of the end portion of the optical fiber according to claim **7**, wherein:

the sealing portion comprises glass that has the same composition as glass composing said optical fiber.

9. The sealing structure of the end portion of the optical fiber according to claim **7**, wherein:

the sealing portion comprises glass that has a melting point lower than glass composing the optical fiber.

10. The sealing structure of the end portion of the optical

fiber according to any one of claims **7** to **9**, wherein:

the optical fiber is mounted and fixed to a connector ferrule.

11. A method for sealing an end portion of an optical fiber, comprising:

forming at said end portion of said optical fiber an end face that is substantially at right angles to an axial direction of said optical fiber in said end portion, wherein said optical fiber comprises a high refractive index core and a low refractive index cladding formed around said core, the cladding comprising a plurality of air holes extending in the axial direction;

inserting a glass powder from said end face into said air holes, said glass powder comprising the same composition as glass composing said optical fiber; and

subsequently heating said end portion of said optical fiber to fuse said glass powder and thereby seal said air holes.

12. A method for sealing an end portion of an optical fiber comprising:

forming at said end portion of said optical fiber an end face that is substantially at right angles to an axial direction of said optical fiber in said end portion, wherein said optical fiber comprises a high refractive index core and a low refractive index cladding formed around said core, the cladding comprising a plurality of air holes extending in the axial direction;

inserting a glass powder from said end face into said air holes, said glass powder comprising a melting point lower than glass composing said optical fiber; and

subsequently locally heating a proximity of an end portion of said air holes to fuse said glass powder and thereby seal said air holes.

13. A method for sealing an end portion of an optical fiber comprising:

forming at said end portion of said optical fiber an end face that is substantially at right angles to an axial direction of said optical fiber in said end portion, wherein said optical fiber comprises a high refractive index core and a low refractive index cladding formed around said core, the cladding comprising a plurality of air holes extending in the axial direction; and

subsequently locally heating a proximity of an end portion of said air holes to fuse said glass powder and thereby seal said air holes.

14. The method for sealing the end portion of the optical fiber according to claim **12** or **13**, wherein:

said end portion of said air holes is locally heated and fused by irradiating thereto carbon dioxide gas laser light to seal said air holes.

15. The method for sealing the end portion of the optical fiber according to any one of claims **12** to **14**, wherein:

said optical fiber is beforehand mounted on and fixed to a connector ferrule.

16. An optical fiber, comprising:

a high refractive index core and a low refractive index

cladding formed around said core, the cladding comprising a plurality of air holes extending in an axial direction of said optical fiber; and

a sealing portion formed at an end portion of said plurality of air holes,

wherein said sealing portion comprises a quartz-based fine particle that has a refractive index equal to or lower than that of said cladding, and an optical adhesive that has a refractive index equal to or lower than that of said cladding.

17. The optical fiber according to claim **16**, wherein:

said quartz-based fine particle has a diameter of **1** μm or less.

18. The optical fiber according to claim **17**, wherein:

said quartz-based fine particle is doped with an additive that reduces the refractive index thereof.

19. The optical fiber according to claim **16**, wherein:

said optical adhesive is a UV-curable optical adhesive.

20. An optical fiber connector, comprising:

said optical fiber as defined in any one of claims **16** to **19** mounted on a ferrule.

21. A connection portion of an optical fiber, comprising:

said optical fiber connected to another optical fiber, said optical fiber comprising a plurality of air holes in a cladding formed around a core of said optical fiber,

wherein said optical fiber is joined end-to-end to said another optical fiber through a refractive index matching agent that has a refractive index at a minimum temperature in practical use lower than that of said core.

22. A connection portion of an optical fiber, comprising:

said optical fiber connected to another optical fiber, said optical fiber comprising a plurality of air holes in a cladding formed around a core of said optical fiber,

wherein said optical fiber is joined end-to-end to said another optical fiber through a refractive index matching agent that has a refractive index at a minimum temperature in practical use lower than that of said cladding.

23. The connection portion of the optical fiber according to claim **21** or **22**, wherein:

said refractive index matching agent has an optical refractive index of 1.458 or less in a 1.3 to 1.55 μm wavelength band at a temperature of -30 °C, and an average refractive index temperature coefficient of -8.0×10^{-4} /°C or more and less than 0 /°C in a temperature range of -30 °C to +70 °C.

24. An optical fiber splicer, comprising:

said connection portion of the optical fiber as defined in any one of claims **21** to **23** housed in a chassis.

25. A connection portion of an optical fiber, comprising:

said optical fiber connected to another optical fiber, said optical fiber comprising a plurality of air holes in a

cladding formed around a core of said optical fiber, wherein said optical fiber is joined end-to-end to said another optical fiber through a refractive index matching mixture that has a refractive index in a temperature range in practical use not more than that of said cladding, and that comprises a micro-body with an average diameter or length of 100 nm or less.

26. The connection portion of the optical fiber according to claim **25**, wherein:

said micro-body is a fine particle comprising mainly pure quartz.

27. The connection portion of the optical fiber according to claim **25** or **26**, wherein:

said refractive index matching mixture comprises a refractive index matching agent with said micro-body mixed therewith, and a mixture weight ratio of said refractive index matching agent and said micro-body is 10:1 to 1:1.

28. An optical fiber splicer, comprising:

said connection portion of the optical fiber as defined in any one of claims **25** to **27** housed in a chassis.